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Requested Patent: WO9803802A1

Title: VIBRATION ISOLATION DEVICE ;

Abstracted Patent: WO9803802 ;

Publication Date: 1998-01-29 ;

Inventor(s): GREGORY MICHAEL HARFORD (AU) ;

Applicant(s):

G P EMBELTON AND CO PTY LTD (AU); GREGORY MICHAEL HARFORD (AU) ;

Application Number: WO1997AU00451 19970717 ;

Priority Number(s): AU1996PO01089 19960717 ;

IPC Classification: F16F7/12; F16F15/04 ;

Equivalents: DE19782026T, GB2330395 ;

ABSTRACT:

A vibration isolation device (15) having first and second components (18, 16). A resilient structure (25) comprised of first and second resilient elements (32, 34) is secured to the second component (16). The first resilient element (32) is positioned between the first and second components (16, 18) and the second resilient (34) element is positioned at a surface of the second component (16) facing away from the first component (18). Coupling means (40, 38, 51, 47, 49) holds the resilient structure (25) under compressive force applied between opposite ends thereof. The coupling means (40, 38, 51, 47, 49) holds one end of the resilient structure (25) against the first component (18) and locates both ends of the resilient structure (25) at a substantially fixed distance with respect to each other in the end to end direction of the resilient structure (25).

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(71) Applicant *(for all designated States except US)*: G.P. EMBELTON AND CO. PTY. LTD. [AU/AU]; 147-149 Bakers Road, Coburg, VIC 3058 (AU).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: GREGORY, Michael, Harford [AU/AU]; 7 Lysander Street, East Brighton, VIC 3187 (AU).

(74) Agents: LESLIE, Keith et al.; Davies Collison Cave, 1 Little Collins Street, Melbourne, VIC 3000 (AU).

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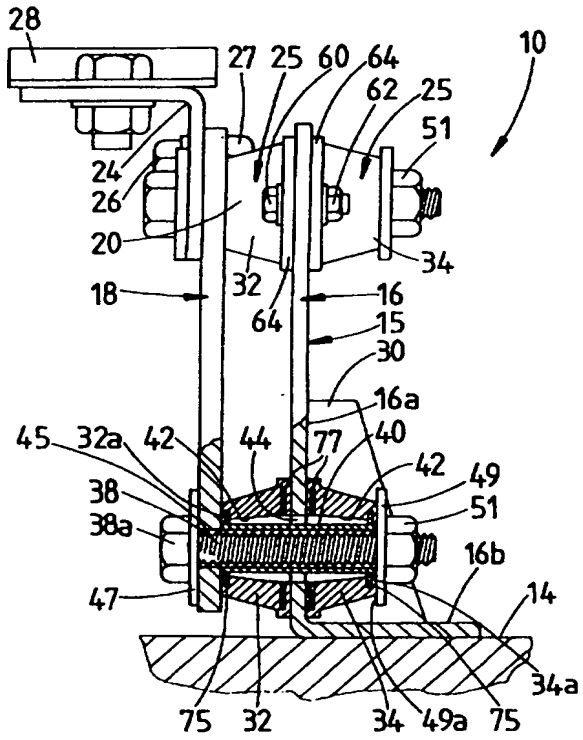
(54) Title: VIBRATION ISOLATION DEVICE

(57) Abstract

A vibration isolation device (15) having first and second components (18, 16). A resilient structure (25) comprised of first and second resilient elements (32, 34) is secured to the second component (16). The first resilient element (32) is positioned between the first and second components (16, 18) and the second resilient (34) element is positioned at a surface of the second component (16) facing away from the first component (18). Coupling means (40, 38, 51, 47, 49) holds the resilient structure (25) under compressive force applied between opposite ends thereof. The coupling means (40, 38, 51, 47, 49) holds one end of the resilient structure (25) against the first component (18) and locates both ends of the resilient structure (25) at a substantially fixed distance with respect to each other in the end to end direction of the resilient structure (25).



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VIBRATION ISOLATION DEVICE

This invention relates to a vibration isolation device. The vibration isolation device of the invention has particular, but not exclusive, application for mounting of rails, such as mounting lift rails to the wall of a lift well.

Rails on which rolling apparatus moves are often secured in position by the use of mounting devices which provide mountings of the rails at spaced locations along the lengths thereto. It not infrequently occurs that substantial forces are transmitted from the rails through the mounting devices to the surroundings supporting medium, and this may give rise to significant noise production. In the case of elevators, the elevator cage may be provided with wheels which engage rails extending vertically through the lift well and the rails may be mounted to the wall of the lift well by means of such mounting devices, with the consequence that substantial sideward movements of the elevator cage occurring during operation will be transmitted to the lift well wall via the rails and the engaging wheels, and via the mounting devices. This may give rise to significant vibration and consequent noise production. The so produced noise is a significant problem in many situations, for example, in apartment buildings.

In one aspect the invention provides a vibration isolation device comprising first and second components, and resilient interconnection means, the resilient interconnection means comprising:

a resilient structure comprised of first and second resilient elements secured to the second component, the first resilient element being positioned between the first and second components and the second resilient element being positioned at a surface of the second component facing away from the first component, and

coupling means holding said resilient structure under compressive force applied between opposite ends thereof, and the coupling means holding one said end of the resilient structure against the first component and locating both said ends at a substantially fixed distance with respect to each other in the end to end direction of the resilient structure.

The resilient elements may have end to end extending openings therethrough with the coupling means extending through these openings and through an opening in the second component. The coupling means may also extend through an opening in the first component, and/or may be fixed thereto.

The coupling means may include a spacer element which is disposed between and in contact with a surface of said first component which faces the second component and with a stop surface of the coupling means disposed adjacent that end of the second resilient element which is away from the second component, or is otherwise arranged to limit the extent of relative inwards movement which can occur as between the ends of the resilient structure.

The coupling means may further include a bolt and nut or other coupling which extends through the components and the resilient elements and which has a sidewardly extending first portion, such as a bolt head or a nut, which bears directly or indirectly against the surface of the first component remote from the second component, and a second substantially sidewardly extending portion, such as a nut or bolt, which bears directly or indirectly against the end of the second resilient element which is away from the second component. The nut may define the stop surface or the stop surface may, for example, be defined on a washer disposed between the nut and the second resilient element.

In another aspect the invention provides a vibration isolation device comprising first and second components and a projecting member which is substantially fixed with respect to the first component and extends through an opening in the second component, a first resilient element being secured to and positioned between and in contact with facing opposed surfaces of the first and second components, and a second resilient element being secured to the second component and positioned against the surface of the second component opposite the first component, means being provided for holding said resilient elements in compression in the direction of extent of the projecting member, between the first to the second component, and means being provided for maintaining the spacing between the ends of the resilient elements which are away from the second component substantially at a predetermined distance, said

opening being sized to permit limited movement of the projecting member therewithin in directions transverse to said direction of extent.

In a still further form the invention provides a vibration isolation device comprising first and second components and a resilient structure to which the second component is fixed, one end of the resilient structure being substantially fixed with respect to the first component and an opposite end of the resilient structure being held in substantially fixed relationship relative to said one end.

The first and second components may be generally planar and parallel.

The vibration isolating devices of the invention may be arranged such that mechanical interconnection between the first and second components is maintained in the event of destruction of the first and second resilient elements.

In a yet further form, the invention provides in combination a first member mounted with respect to a support surface by a mount incorporating any vibration isolation device as above described. In this case, the first member may comprise a rail or other elongate member and the vibration isolation device may be arranged with the end to end direction of the resilient elements, or the direction of extent of the projecting member, or the direction of spacing between the first and second components generally parallel to the direction of extent of the elongate member. Where the first and second components are generally parallel, they may be transverse to the first member.

The invention is further described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a side view of a rail mount incorporating a vibration isolation device constructed in accordance with the invention; and

Figure 2 is a partly sectioned end view of the rail mount of Figure 1.

The rail mount 10 is arranged to connect between a rail 12 and the surface 14a of a lift well 14. Generally, there will be a number of mounts 10 arranged at spaced locations along the length of the rail. These may be similarly formed, as next described.

The rail mount includes an isolation device 15 which comprises first and second components 16,18 interconnected by three resilient couplings 20. Component 18 is in the form of a rectangular plate, and component 16 has a rectangular plate portion 16a, of approximately the same size as component 18, and an integral angled bracket portion 16b at one edge. Portion 16b is in use mounted to surface 14a by suitable means such as bolts or the like (not shown) so that portion 16a extends normally from the surface.

The components 16,18 are coupled together in substantially parallel relationship by the three resilient couplings 20.

A bracket 24 in the form of an elongate angle piece is affixed to component 18 so as to extend along a marginal portion of the component 18 remote from that edge of component 18 which is in use adjacent the surface 14a. This bracket 24 is clamped in position on the component 18 by bolts 26 which pass through aligned openings in the bracket 24 and component 18, and by nuts 27 which are threadedly engaged with these. The openings in one or more of the component 18 and bracket 24, and through which bolts 26 pass, may be elongate as shown in Figure 1 to enable adjustment of the position of the bracket relative to the component 18.

Bracket 24 carries two clamp elements 28 which are bolted to the bracket 24 and which in use engage outstanding flange portions 12a,12b (Figure 1) on rail 12 to hold the rail in position on the bracket 24 and thus to hold it in position relative to the remainder of the device 10. Component 16 may be suitably reinforced, such as by provision of the webs 30 shown which extend between portions 16a,16b thereof.

The resilient couplings 20 each comprise a resilient structure 25 formed of two substantially frustoconical resilient elements 32,34 which are positioned one to either side of the portion 16a of component 16 with the larger diameter ends thereof each adjacent the portion 16a.

The following description next describes one of the couplings 20, the three couplings 20 being substantially identical. Thus, elements 32,34 are arranged in coaxially aligned relationship. They are secured to the portion 16a of component 16 by bolts 60 and threadedly engaged nuts 62, the bolts 60 passing through openings in the portion 16a disposed at sidewardly extending flanges 64 at the larger diameter ends of the elements 32,34. The flanges 64 are positioned against the side surfaces of the portion 16a.

Elements 32,34 have axial openings 42 therethrough. A bolt 38 extends from the side of component 18 remote from component 16, through a washer 47, through an opening 45 in the component 18, coaxially through opening 42 in element 32, through an axially aligned opening 44 in component 16 and thence through opening 42 in element 34, to project from the outer, smaller diameter, end of element 34 and through a washer 49 disposed on the outer end of the element 34. A nut 51 is threadedly engaged on the outer end of the bolt 38. The nut 51 is tightened on the bolt 38 so that the bolt head 38a bears against washer 47 and the nut 38b bears against washer 49 to apply compressive force to the elements 32,34.

A hollow cylindrical spacer 40 is arranged coaxially on the shank of bolt 38 and is disposed between components 32,34 and within bores 42 and extending through opening 44. Spacer 40 is of somewhat larger diameter than openings 45 and the internal diameter of washer 49 and, when nut 51 is tightened sufficiently, the ends of the spacer are brought into respective engagement with the inner surface of the component 16 and with the washer 49, so limiting the degree of compression of elements 32,34. That is, the washer 49 defines a fixed stop surface 49a which bears against the outer end of the resilient element.

In the tightened condition of nut 51, the spacer 40 and bolt 38 and nut 51 provide an

interconnection between the components 16,18 at which the bolt, nut and spacer are rigidly coupled to the component 16. On the other hand, component 16 is fixedly connected to the inner ends of the resilient elements 32,34.

The outer ends of the resilient elements resiliently bear against the inner surface of component 16 and against washer 49. At these outer ends of the resilient elements, the openings 42 are provided with washers 75 which are moulded into the resilient elements and are arranged coaxially within these. The openings 42 of the resilient elements 32,34 also have integral inwardly extending circular flanges 32a,34a at the outer ends, immediately adjacent the washers 75. The internal diameter of these washers 75 is only slightly greater than the external diameter of the spacer 40 and the spacer passes through these with only small clearance, so limiting the movement of the outer ends of the elements 32,34 radially with respect to the axis of bolt 38. In this way, then, the outer ends of the elements 32,34 are substantially fixedly located relative to the bolt 38 and thus also with respect to component 18, spacer 40 and washer 49.

The opening 44 is somewhat larger than the outside diameter of the spacer 40 and a degree of relative movement transverse to the axis of bolt 38 is therefore permitted as between the bolt 38 and the component 16, which movement is however limited by resilient deformation of the elements 32,34 and consequently generated resilient forces. Some degree of axial relative movement of the component 16 relative to the bolt 38 is also possible, this being resisted by resilient axial compression or tension forces arising from the resultant resilient deformation of the elements 32,34.

Elements 32,34 have at the inner ends thereof embedded planar apertured members 77 which are coaxially arranged within openings 42 and assist in providing rigidity and in facilitating mounting of the elements 32,34 to the component 16. These members have sideward extensions with apertures through which bolts 60 pass and a central aperture which is coaxially arranged with respect to opening 42. As shown, openings 42 are, at least in the compressed state of the resilient elements 32,34, somewhat frustoconical in form, varying in

diameter from a larger diameter at the inner ends of the resilient elements, to smaller diameters at the outer ends. The larger diameter end of the opening 42 is of diameter substantially equal to the central internal diameter of member 77.

It has been found that, in use, the described arrangement is particularly effective in reducing vibration and consequent noise. The arrangement also has the advantage that in the event of destruction of the elements 32,34, such as by fire, the holding between the components 16,18 is not completely destroyed since the bolts 38 will still hold the elements together, albeit somewhat loosely. That is, if the elements 32,34 are not present the bolt 38 still extends through both components 16,18 and these are loosely held together since the washer 49 is of greater diameter than opening 44 in component 16.

The mounting provided by the isolation device 15 is relatively stiff in the axial directions of bolts 38, but less so in directions transverse to the bolt axes, so providing desirable mounting characteristics for rail 12. In the particularly described arrangement, the planes of the components 16,18 are transverse to the lengthwise direction of extent of the rail 12. Thus, the direction in which the isolation device 15 exhibits greatest stiffness as between the components 16,18 is aligned with the direction of extent of the rail. The stiffness prescribed in directions transverse to that direction is less.

It has been found satisfactory to provide three resilient couplings 20, although greater or smaller numbers may be employed if desired. In the arrangement shown, there are two resilient couplings 20 disposed close to the bracket 24 and with the axes of these immediately outside the locations of bolts 265 (as viewed in Figure 1) and only slightly below an imaginary line joining the axes of bolts 26. There is a single centrally located resilient coupling 20 disposed adjacent the portion 16a of component 16. This arrangement is particularly effective. In general it is desirable to have at least two resilient couplings, to limit relative movement between components 16,18 in the event of destruction of the resilient elements 32,34, and to position at least one resilient coupling close to the location of the rail.

The resilient elements may be formed of relatively hard rubber composition. but any suitable resilient material may be employed.

The described arrangement has been advanced merely by way of explanation and many modifications may be made thereto without departing from the spirit and scope of the invention as defined in the appended claims.

CLAIMS:-

1. A vibration isolation device comprising first and second components, and resilient interconnection means, the resilient interconnecton means comprising:

a resilient structure comprised of first and second resilient elements secured to the second component, the first resilient element being positioned between the first and second components and the second resilient element being positioned at a surface of the second component facing away from the first component; and

coupling means holding said resilient structure under compressive force applied between opposite ends thereof, and the coupling means holding one said end of the resilient structure against the first component and locating both said ends at a substantially fixed distance with respect to each other in the end to end direction of the resilient structure.

2. A vibration isolation device as claimed in claim 1 wherein the resilient elements have end to end extending openings therethrough with the coupling means extending through these openings and through an opening in the second component.

3. A vibration isolation device as claimed in claim 1 or claim 2 wherein the coupling means extends through an opening in the first component.

4. A vibration device as claimed in any preceding claim wherein the coupling means is fixed to the first component.

5. A vibration isolation device as claimed in any preceding claim wherein the coupling means includes a spacer element which is disposed between and in contact with a surface of said first component which faces the second component, a stop surface of the coupling means being disposed adjacent that end of the second resilient element which is away from the second component.

6. A vibration isolation device as claimed in any one of claims 1 to 5 including means limiting the extent of relative inwards movement which can occur as between the ends of the resilient structure.

7. A vibration isolation device as claimed in claim 6 wherein the coupling means includes a coupling which extends through the components and the resilient elements and which has a first sidewardly extending portion, which bears directly or indirectly against the surface of the first component remote from the second component, and a second sidewardly extending portion, which bears directly or indirectly against the end of the second resilient element which is away from the second component.

8. A vibration isolation device as claimed in claim 7 wherein said coupling comprises a bolt and a nut, said net being threadedly engaged with the bolt, said sidewardly extending portions comprise head of the bolt and the nut.

9. A vibration isolation device as claimed in claim 8 wherein the nut defines the stop surface.

10. A vibration isolation device as claimed in claim 8 wherein the stop surface is defined on a washer disposed between the nut and the second resilient element.

11. A vibration isolation device comprising first and second components and a projecting member which is substantially fixed with respect to the first component and extends through an opening in the second component, a first resilient element being secured to and positioned between and in contact with facing opposed surfaces of the first and second components, and a second resilient element being secured to the second component and positioned against the surface of the second component opposite the first component, means being provided for holding said resilient elements in compression in the direction of extent of the projecting member, between the first to the second component, and means being provided for maintaining the space between the ends of the resilient elements which are away from the

second component substantially at a predetermined distance, said opening being sized to permit limited movement of the projecting member therewithin in directions transverse to said direction of extent.

12. A vibration isolation device comprising first and second components and a resilient structure to which the second component is fixed, one end of the resilient structure being substantially fixed with respect to the first component and an opposite end of the resilient structure being held in substantially fixed relationship relative to one said end.

13. A vibration isolation device as claimed in claim 12 wherein the first and second components are generally planar.

14. A vibration isolation device as claimed in any preceding claim, arranged such that mechanical interconnection between the first and second components is maintained in the event of destruction of the first and second resilient elements.

15. In combination, a first member mounted with respect to a support surface by a mount incorporating a vibration isolation device as claimed in any preceding claim.

16. The combination of claim 15, wherein the first member comprises a rail or other elongate member and the vibration isolation device is arranged with the end to end direction of the resilient elements generally parallel to the direction of extent of the elongate member.

17. The combination of claim 15 wherein the first member comprises a rail or other elongate member and the vibration isolation device is arranged with the direction of spacing between the first and second components generally parallel to the direction of extent of the elongate member.

18. The combination of claim 15 as appended directly or indirectly to claim 11 wherein the first member comprises a rail or other elongate member and the vibration isolation device

is arranged with the direction of extent of the projecting member generally parallel to the direction of extent of the elongate member.

19. The combination of any one of claims 15 to 18 wherein the first and second components are transverse to the first member.

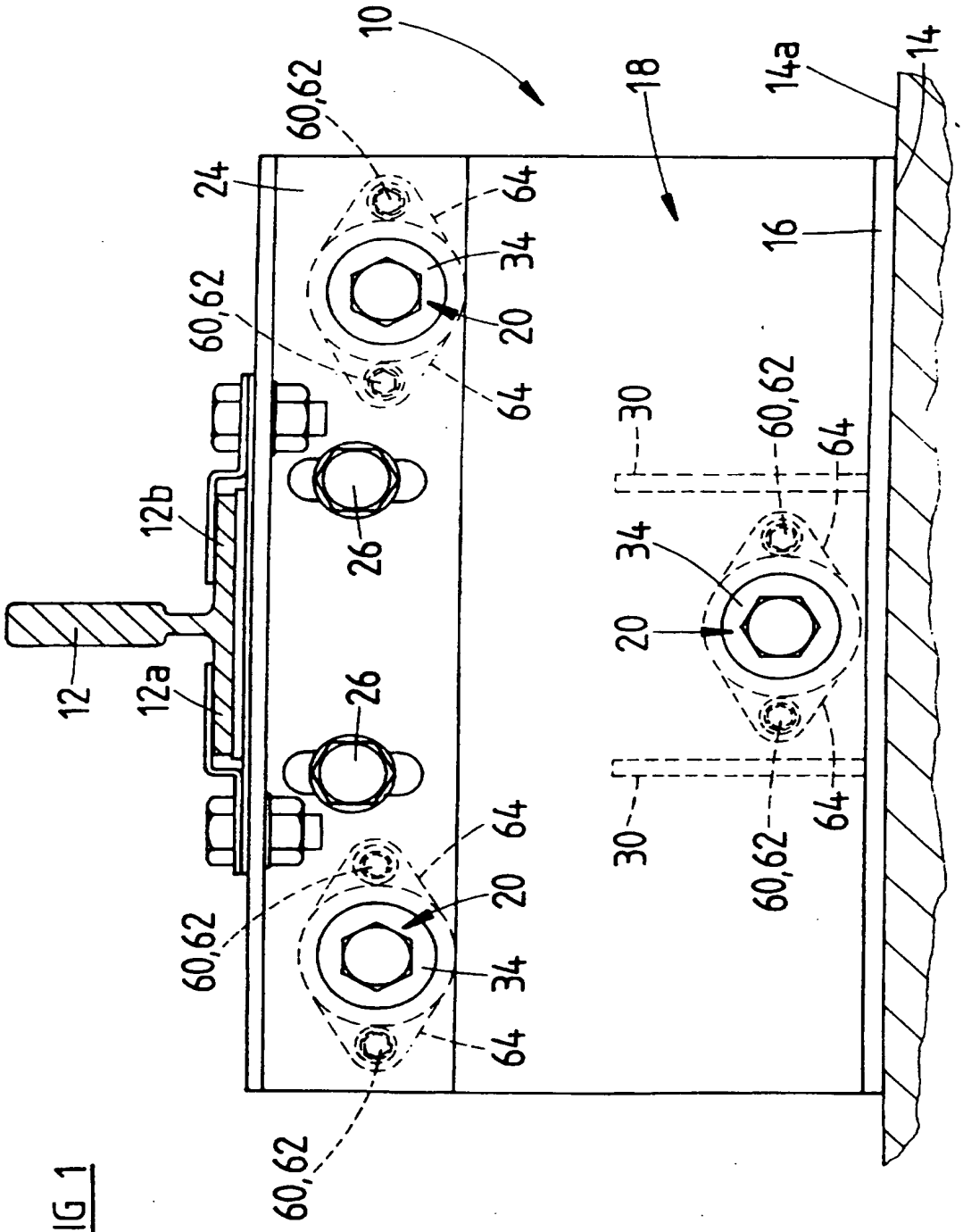
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FIG 1

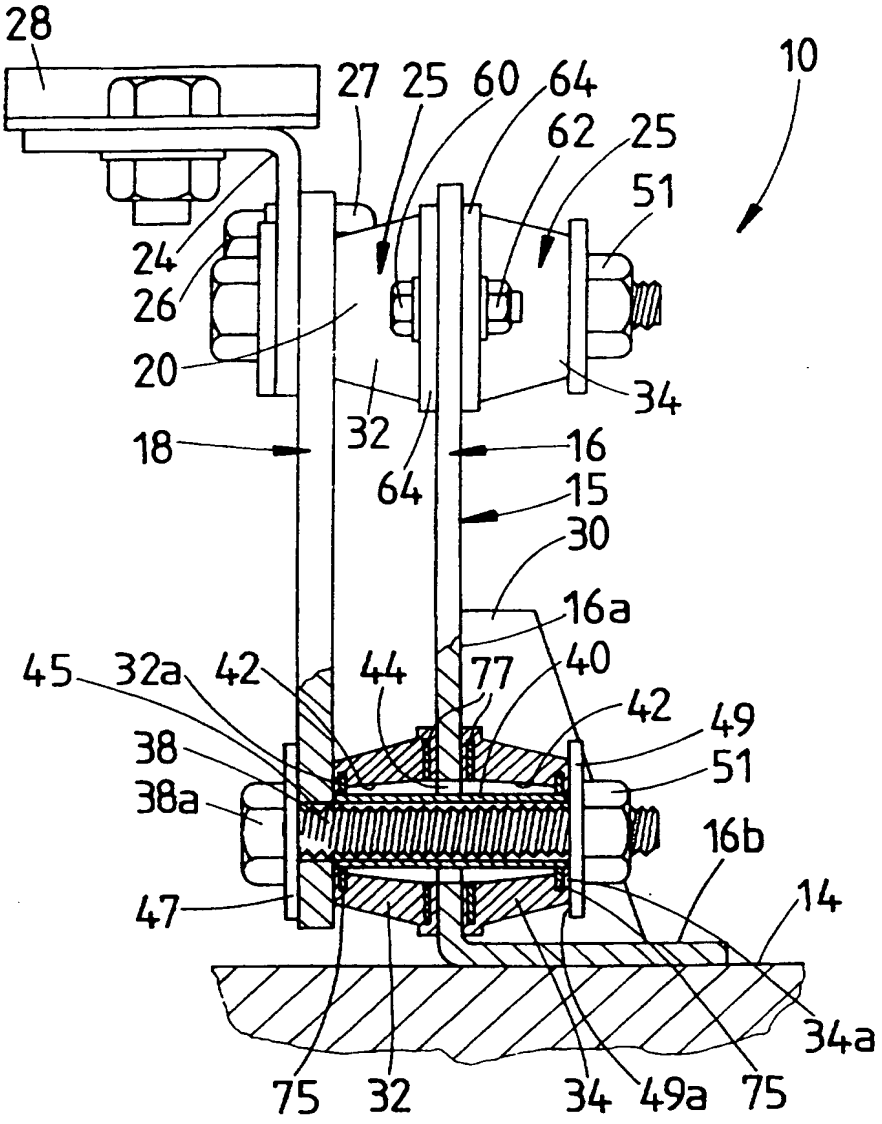
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FIG 2

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 97/00451

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: F16F 7/12, 15/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC F16F 7/12, 15/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 11552/70 A (VAUXHALL MOTORS LIMITED) 19 August 1971 line 8 page 4 to line 26 page 6	1-19
X	AU 44586/89 A (NAVISTAR INTERNATIONAL TRANSPORTATION CORP.) 31 May 1990 line 15 page 4 to line 5 page 10	1-19
X	AU 12367/76 (499401) B (MITSUBISHI JIDOSHA KOGYO KABUSHIKI KAISHA) 29 September 1977 line 21 page 4 to line 23 page 6	1-19

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Date of the actual completion of the international search	Date of mailing of the international search report
29 August 1997	12 SEP 1997
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INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 97/00451

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 87/02344 A (INLIFTOR AB) 23 April 1987	
A	GB 2125362 A (MITSUBISHI DENKI K.K.) 7 March 1984	
A	GB 2098466 A (GKN SNAKEY LIMITED) 23 June 1982	
A	EP 353091 A (SANDEN CORPORATION) 31 January 1990	

INTERNATIONAL SEARCH REPORT
Information on patent family members

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		US	4043585	JP	51112029		
WO	8702344	AU	64783/86	EP	276220	FI	881483
		US	4773507				
GB	2125362	CA	1200212	HK	844/86	MY	113/87
EP	353091	JP	1271420	US	5371142		

END OF ANNEX